



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/603,852	06/25/2003	Kenneth C. Wu	ASC-022CPCN	3708
21323	7590	01/04/2005	EXAMINER	
TESTA, HURWITZ & THIBEAULT, LLP HIGH STREET TOWER 125 HIGH STREET BOSTON, MA 02110			OWENS, DOUGLAS W	
			ART UNIT	PAPER NUMBER
			2811	

DATE MAILED: 01/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/603,852

Applicant(s)

WU ET AL.

Examiner

Douglas W. Owens

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 October 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 112-135, 137, 140-147, 150-183 and 185-241 is/are pending in the application.
- 4a) Of the above claim(s) 135, 137, 147, 150, 155, 183, 185-187, 237 and 238 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 140-143, 159-170, 177, 178, 181, 182, 188-197, 229-232 and 239 is/are allowed.
- 6) ☒ Claim(s) 112-115, 117-125, 130-132, 144-146, 151-154, 156-158, 171-176, 198, 199, 201-203, 205-207, 236, 240 and 241 is/are rejected.
- 7) ☒ Claim(s) 116, 126-129, 133, 134, 179, 180, 200, 204, 208-228, 234 and 235 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 9/01/04.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Newly submitted claim 237, directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: The invention of claim 237 is classified in class 257, subclass 296+, having acquired a separate status in the art as shown by the different classification, restriction for examination purposes as indicated is proper.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claim 237 is withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Additionally, amended claims 135, 137, 147, 150, 155, 183, 185 – 187 and new claim 238 are directed to a different species of the invention. Accordingly, claims 135, 137, 147, 155, 183, 185 – 187 and 238 are also withdrawn from consideration.

Specification

2. The disclosure is objected to because of the following informalities: line 4 of page 13 requires that x is less than 18, which would mean that the SiGe alloy could possibly comprise $\text{Si}_{.16}\text{Ge}_{.17}$, which does not seem to be the intent of the disclosure. Should this be 0.18?

Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 112 – 115, 117 – 125, 130 – 132, 144 – 146, 151 – 154, 156 – 158, 171 – 176, 198, 199, 201 – 203, 205 – 207, 233 and 236 are rejected under 35 U.S.C. 102(b) as being anticipated by US Patent No. 5,906,951 to Chu et al.

Regarding claim 112, Chu et al. teaches a semiconductor structure (Fig. 2) comprising:

a layer structure including a uniform etch-stop layer (14) having a doping level below 10^{18} atoms/cm³, since layer 14 is not doped.

Regarding claim 113, Chu et al. teaches a semiconductor device, wherein the uniform etch-stop layer is relaxed.

Regarding claim 114, Chu et al. teaches a semiconductor device, wherein the uniform etch-stop layer comprises Si_{1-y}Ge_y.

Regarding claim 115, Chu et al. teaches a semiconductor device, wherein $y > 0.19$.

Regarding claim 117, Chu et al. teaches a semiconductor device, wherein the surface of the etch stop layer is planarized.

Art Unit: 2811

Regarding claim 118, Chu et al. teaches a semiconductor device, wherein the layer structure comprises a strained layer (16, 17) disposed over the uniform etch stop layer.

Regarding claim 119, Chu et al. teaches a semiconductor device, wherein the strained layer comprises $\text{Si}_{1-z}\text{Ge}_z$ and $0 \leq z < 1$.

Regarding claim 120, Chu et al. teaches a semiconductor structure, further comprising an insulator layer (28) over the layer structure.

Regarding claim 121, Chu et al. teaches a semiconductor structure further comprising:

an additional wafer (26),
wherein the layer structure is bonded to the additional wafer (Col. 3, lines 20 – 25).

With respect to the requirement of the additional wafer being used as a handle wafer, this is considered a suggested use limitation and is not given any patentable weight. (See *In re Casey*, 370 F.2d 576, 152 USPQ 235 (CCPA 1967); *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963)).

Regarding claim 122, Chu et al. teaches a structure, wherein the handle wafer comprises an insulator (28).

Regarding claims 123 and 124, Chu et al. teaches a structure, wherein the additional wafer comprises silicon and silicon dioxide.

Regarding claim 125, Chu et al. teaches a structure, wherein the layer structure comprises a relaxed layer (18).

Regarding claim 130, Chu et al. teaches a structure, wherein the relaxed layer is disposed over the etch stop layer.

Regarding claim 131, Chu et al. teaches a structure, further comprising a semiconductor substrate (26) disposed over the relaxed layer.

Regarding claim 132, Chu et al. teaches a structure, wherein inverting the illustrated orientation of the embodiment in Fig. 2, would result in the relaxed layer (18) being disposed under the uniform etch-stop layer. Since the device can operate in any orientation, changing the orientation of the device to accommodate a plurality of applications does not amount to a change in the device structure.

Regarding claim 144, Chu et al. teaches a semiconductor structure, comprising:
a layer structure (Fig. 2) including:
a uniform etch-stop layer (14); and
a strained etch-stop layer (16, 17) disposed over the uniform etch-stop layer, and
an insulator structure (28) over the layer structure.

The strained layers (16 and 17) disposed over the uniform etch-stop layer could also function as etch stop layers. Accordingly, the added limitation of this being an etch-stop layer is considered functional language. Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). “[A]pparatus claims cover what a device is, not what a device does.” *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990).

Art Unit: 2811

Regarding claim 145, Chu et al. teaches a structure, wherein the etch-stop layer comprises relaxed $\text{Si}_{1-y}\text{Ge}_y$.

Regarding claim 146, Chu et al. teaches a structure, wherein the strained etch-stop layer comprises $\text{Si}_{1-z}\text{Ge}_z$ and $0 \leq z < 1$.

Regarding claim 151, Chu et al. teaches a structure, comprising:

a first uniform etch stop layer (14);

a second etch stop layer (17) disposed over the uniform etch stop layer; and

a substantially relaxed layer (18) over the second etch stop layer.

Chu et al. inherently teaches that the uniform etch-stop layer has a relative etch rate which is less than approximately the relative etch rate of silicon doped with 7×10^{19} boron atoms/cm³, since the etch-stop layer of Chu et al. is identical to that of the instant application.

Regarding claim 152, Chu et al. teaches a structure, wherein the first etch stop layer comprises substantially relaxed $\text{Si}_{1-y}\text{Ge}_y$.

Regarding claim 153, Chu et al. teaches a structure, wherein the second etch stop layer comprises strained $\text{Si}_{1-z}\text{Ge}_z$.

Regarding claim 154, Chu et al. teaches a structure, wherein $0 \leq z < 1$.

Regarding claim 156, Chu et al teaches a structure, wherein the relaxed layer comprises $\text{Si}_{1-w}\text{Ge}_w$.

Regarding claim 157, Chu et al. teaches a structure, further comprising:

an additional wafer (26) comprising an insulator (28),

wherein the relaxed layer is indirectly bonded to the additional wafer.

Art Unit: 2811

With respect to the requirement of the additional wafer being used as a handle wafer, this is considered a suggested use limitation and is not given any patentable weight. (See *In re Casey*, 370 F.2d 576, 152 USPQ 235 (CCPA 1967); *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963)).

Regarding claim 158, Chu et al. teaches a structure, wherein the additional wafer (handle wafer) comprises silicon.

Regarding claim 171, Chu et al. teaches a method for making a semiconductor structure (Fig. 2), the method comprising:

- providing a first substrate (12); and

- forming a layer structure over the first substrate by:

 - forming a uniform etch stop layer (14) over the first substrate, the uniform etch-stop layer having a doping level below 10^{18} atoms/cm³.

Regarding claim 172, Chu et al. teaches a method, wherein the etch stop layer comprises relaxed Si_{1-y}Ge_y.

Regarding claim 173, Chu et al. teaches a method, wherein the strained layer comprises Si_{1-z}Ge_z and $0 \leq z < 1$.

Regarding claim 174, Chu et al. teaches a method, further comprising:

- providing a second substrate (28, 26); and

- bonding the layer structure to the second substrate (Col. 3, lines 20 – 25).

Regarding claim 175, Chu et al. teaches a method, wherein the second substrate comprises silicon.

Regarding claim 176, Chu et al. teaches a method, further comprising:

Art Unit: 2811

forming an insulator layer (28) over the strained layer.

Regarding claim 198, Chu et al. teaches a method for forming a semiconductor structure, the method comprising:

forming a strained etch stop layer (17); and

forming a substantially relaxed $\text{Si}_{1-w}\text{Ge}_w$ layer (18) over the etch stop layer, wherein $w > 0$.

Regarding claim 199, Chu et al. teaches a method, wherein the etc-stop layer comprises $\text{Si}_{1-z}\text{Ge}_z$, and wherein $0 \leq z < 1$.

Regarding claim 201, Chu et al. teaches a method for forming a semiconductor structure, comprising:

forming a first uniform etch stop layer (14);

forming a second etch-stop layer (15, 17) over the uniform etch stop layer; and

forming a substantially relaxed layer (18) over the second etch-stop layer;

Chu et al. inherently teaches that the uniform etch-stop layer has a relative etch rate which is less than approximately the relative etch rate of silicon doped with 7×10^{19} boron atoms/cm³, since the etch-stop layer of Chu et al. is identical to that of the instant application.

Regarding claim 202, Chu et al. teaches a method, wherein the first etch stop layer comprises substantially relaxed $\text{Si}_{1-y}\text{Ge}_y$.

Regarding claim 203, Chu et al. teaches a method, wherein the second etch stop layer (17) comprises strained $\text{Si}_{1-z}\text{Ge}_z$ and $0 \leq z < 1$.

Regarding claim 205, Chu et al. teaches a method, wherein the relaxed layer comprises $\text{Si}_{1-w}\text{Ge}_w$.

Regarding claim 206, Chu et al. teaches a method, further comprising:
indirectly bonding the substantially relaxed layer to a substrate (26, 28) comprising an insulator (col. 3, lines 20 – 25).

Regarding claim 207, Chu et al. teaches a method, wherein the substrate comprises silicon.

Regarding claim 233, Chu et al. inherently teach a semiconductor structure, wherein the uniform etch-stop layer has a relative etch rate which is less than approximately the relative etch rate of silicon doped with 7×10^{19} boron atoms/cm³, since the etch-stop layer of Chu et al. is identical to that of the instant application.

Regarding claim 236, Chu et al. teach a semiconductor structure, wherein the uniform etch-stop layer is undoped.

Regarding claim 240, Chu et al. teach a method of making a semiconductor device, wherein forming the layer structure comprises forming a strained layer (16, 17) over the uniform etch stop layer.

Regarding claim 241, Chu et al. teach a method of making a semiconductor device, wherein the uniform etch-stop layer inherently has a relative etch-rate which is less than the relative etch-rate of Si doped with 7×10^{19} boron atom/cm³, since the material is identical to that of the claimed invention.

Allowable Subject Matter

2. Claims 140 – 143, 159 – 170, 177, 178, 181, 182, 188 – 197, 229 – 232 and 239 are allowed.

3. Claims 116, 126 – 129, 133, 134, 179, 180, 200, 204, 208 – 228, 234 and 235 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

4. Applicant's arguments filed October 13, 2004 have been fully considered but they are not persuasive.

Applicant argues that Chu et al. do not teach a structure, having an etch stop layer with a doping level below 10^{18} atoms/cm³, asserting that Chu et al. teach an etch stop layer having a dopant concentration in the range of 5×10^{19} to 5×10^{20} . It is agreed that Chu et al. teach an etch stop layer (15) having the doping concentration in the range of 5×10^{19} to 5×10^{20} . However, this is not the layer that was cited in the rejection of the claims. The relaxed Si_{1-x}Ge_x layer (14) is the same material as that of the instant application, and is well capable of functioning as an etch stop layer, as demonstrated by Applicant. Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). “[A]pparatus claims cover what a device is, not what a device does.” *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990). For this reason, the fact that Applicant uses this layer for an etch

stop is not given patentable weight, particularly since the material taught by Chu et al. is identical. Moreover, the etch stop layer (14) taught by Chu et al. is not doped, so it has a doping level well below the cited 10^{18} atoms/cm³.

Applicant argues that Chu et al. do not teach a structure having two etch stop layers. Chu et al. teach a structure (Fig. 2) having several layers (14, 16, 17) comprising materials that can be used as etch stop layers, which Applicant does indeed use as etch stop layers. As discussed above, the requirement of this material being used as an etch-stop layer is a suggested use limitation, which has not been given any patentable weight. The material has use in the art as an etch stop layer, and is formed on the layered structure taught by Chu et al.

Applicant argues, with respect to claim 198, that Chu et al. do not teach a strained etch-stop layer, but a relaxed etch stop layer. Chu et al. teach a strained layer (17) that is the same as the material of the claimed invention, which is capable of being used as an etch-stop layer, as discussed above.

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

Art Unit: 2811


extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas W. Owens whose telephone number is 571-272-1662. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DWO



EDDIE LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800